AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings includes changes to Figures 5 and 6. Figures 5 and 6 have been labeled as "Prior Art."

Attachments: Replacement sheets

REMARKS

Claims 1-6 are present in this application. Claims 1 and 2 are independent.

Drawings

The drawings have been objected to for not labeling Figures 5 and 6 by a legend such as "Prior Art." Applicant provides herewith corrected drawings showing Figures 5 and 6 with the label "Prior Art."

Claim Rejection – 35 U.S.C. § 103; Miyoshi

Claim 1

Claim 1 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Prior Art disclosed in the present application in view of U.S. Patent 4,897,536 (Miyoshi). Applicant traverses this rejection.

Claim 1 is directed to embodiments of a triangulation-type optical displacement sensor. The triangular-type optical displacement sensor includes, among other things, a light receiving element (e.g., light-receiving element 12) receiving at least a portion of the light reflected from the distance measurement target, for which a distance measurement L is to be determined. The source light-emitting element (e.g., light-emitting element 11) emits a light beam that is narrowed by a slit (e.g., slit 13) and projected onto the distance measurement target. Light diffusely reflected by distance measurement target is narrowed by a slit (e.g., slit 14) and guided to a light-receiving surface (e.g., light-receiving surface 12a).

Because the location and size of the slit for the light-emitting element can be set for the size of the spot to be projected onto the distance measurement target, the distance between the slit and the light-emitting element can be made short. Also, because the size of the slit is small, the overall size of the displacement sensor can be made small. (Present specification at paragraph 0014.)

Thus, according to claim 1, the triangulation-type optical displacement sensor includes, among other things, at least one slit for narrowing at least one light beam projected toward at least one of the distance measurement targets, and the at least one slit for narrowing at least a portion of the light reflected from the at least one of the distance measurement targets.

The Office Action relies on prior art disclosed in the present application for teaching features of the claimed invention except for the feature of at least one slit for narrowing at least one light beam projected toward at least one distance measurement target, and at least one slit for narrowing at least a portion of the light reflected from said at least one of the distance measurement target. The Office Action instead relies on Miyoshi (primarily Fig. 4) for teaching the missing elements of the disclosed prior art. In particular, the Office Action states that Miyoshi teaches an optical axis displacement sensor comprising a laser source 30, a CCD line sensor 50, and a light shielding plate 44. The light shielding plate 44 includes at least one slit 45, 46a, 46b, and wherein the slit 45 "for narrowing at least one light beam projected toward at least one distance measurement targets" S, S', and said at least one slit 46a, 46b "for narrowing at least a portion of the light reflected from said at least one of the distance measurement targets" S, S'.

Miyoshi

A careful analysis of Miyoshi reveals that it teaches away from the use of a triangulation method. In fact, Miyoshi points out that the triangulation method is unsuitable for measurement of distances from three-dimensional surfaces, in that the triangulation technique can result in measurement error when a "shadow effect" occurs (as shown in Fig. 3 of Miyoshi).

Figure 4, primarily relied on in the Office Action, shows a solution to the problem of "shadow effect." The arrangement shown in Fig. 4 shows a knife-edge-type positioning sensor. The arrangement shown in Fig. 4 represents an improvement over prior art knife-edge positioning sensors, which have drawbacks discussed in col. 2, line 40, to col. 3, line 15 of Miyoshi.

Differences over Miyoshi

Unlike the triangulation-type optical displacement sensors of the disclosed prior art, Miyoshi actually teaches away from the use of the triangulation technique and instead discloses a knife-edge-type displacement sensor (Figs. 2 and 4). Accordingly, Applicant submits that one of ordinary skill in the art would not have been motivated to look to Miyoshi for teachings related to improvements to the prior art triangulation techniques disclosed in the present application. Furthermore, hole 45 of Miyoshi's knife-edge-type displacement sensor, for example, is not disclosed as being a slit for narrowing a light beam. Rather, the hole 45 merely passes light.

Thus, Applicant submits that Miyoshi in combination with the prior art disclosed in the present application fails to teach each and every claimed element, and in particular the claimed slits for narrowing a light beam. In addition, at least because Miyoshi is directed to a knife-edge-type displacement sensor and Miyoshi's hole 45 is not disclosed as having a structure for narrowing a light beam, Applicant submits that it would not have been obvious to one of ordinary skill in the art to combine a triangulation-type optical displacement sensor of the disclosed prior art with teachings of the knife-edge-type displacement sensor of Miyoshi in order to reduce and narrow bandwidth wavelength for measuring with high accuracy the displacement of a target surface in wide range. Accordingly, Applicant submits that the rejection fails to establish *prima facie* obviousness and requests that the rejection be reconsidered and withdrawn.

Claim Rejection – 35 U.S.C. § 103; Rudd, Breyer

Claim 2

Claim 2 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,519,204 (Rudd) in view of U.S. Patent 5,065,526 (Breyer). Applicant traverses this rejection.

Claim 2 is directed to embodiments of a triangulation-type optical displacement sensor. The triangulation-type optical displacement sensor includes at least one light-receiving element for receiving at least a portion of the light reflected from at least one of the distance measurement targets and being disposed such that at least one light-receiving surface is substantially perpendicular to at least one optical axis of at least a portion of the projected light.

The triangulation-type optical displacement sensor of claim 2 includes, among other things, at least one slit for narrowing at least one light beam projected toward at least one of the distance measurement targets, and at least one light collecting element collecting at least a portion of the light reflected from the at least one of the distance measurement targets.

The Office Action relies on Rudd for teaching a triangulation-type displacement system, but admits that it does not disclose at least one slit for narrowing the light beam towards the target. Instead, the Office Action relies on Breyer for teaching the missing element.

Rudd

Rudd is directed to exposure control in light-based measurement instruments ("Title"), and in particular exposure control in CCD-based instruments ("Summary of the Invention"). An embodiment shown in Fig. 2 is a triangulation range sensing system. A diode laser 18, focusing lens 20, receiver optics 22 and detector 24 are mounted inside a case. Light from the diode laser 18 is focused to a small spot (typically 25μm) on an object. Reflected light 21 from the object passes through the receiver optics and is finally focused to image spot 23 (typically 400μm) on a CCD array detector. (col. 4, lines 6 – 25).

Differences over Rudd

Unlike the invention of claim 2, Rudd does not teach at least one light-receiving surface that is substantially perpendicular to at least one optical axis of a portion of projected light. Furthermore, as admitted in the Office Action, Rudd fails to teach a slit for narrowing a light beam projected toward the distance measurement target.

Breyer

The Office Action states that Breyer teaches at least one aperture (23 of fig. 3) for narrowing at least one light beam projected toward at least one distance measurement target (citing col. 4, lines 20-32).

An embodiment disclosed in Breyer is an optical probe head (Fig. 3). The optical probe head is a triangulation sensor which includes a laser diode 28 from which a measuring point is projected through aperture 23 onto the object 10 to be measured. An optic 29 receives an image of the measuring region via aperture 22 and, in turn, images the projected measuring point onto a diode array 30. The distance L to the object 10 is determined based on the displacement of the measuring point on the diode array. (col. 4, lines 19-31).

Temperature-dependent correction of the length measurement values of the probing device is made using a temperature sensor in the form of a measuring resistor 27 mounted in the housing 24. (col. 4, lines 41-56).

Differences over Breyer

Unlike the slit recited in claim 2, Breyer's aperture 23, by definition, pass light into the housing. Breyer does not disclose a structure such that the aperture narrows a light beam.

Combination of Rudd and Breyer

As Rudd fails to teach at least one light-receiving surface that is substantially perpendicular to at least one optical axis of a portion of projected light, as well as the claimed at

least one slit for narrowing a light beam, and Breyer also does not teach the claimed at least one slit for narrowing a light beam, Applicant submits that the rejection fails to establish *prima facie* obviousness for claim 2. Accordingly, Applicant requests reconsideration and withdrawal of the rejection.

Claim Rejection – 35 U.S.C. § 103; Miyoshi, Reichard

Claim 4

Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over the prior art disclosed in the present application in view of Miyoshi, and further in view of U.S. Patent 3,740,563 (Reichard). Applicant traverses this rejection.

The same arguments as in the above for claim 1 apply as well to claim 4. At least for the reasons above for claim 1, Applicant submits that the rejection fails to establish *prima facie* obviousness for claim 4.

Claim 4 is directed to the arrangement of claim 1 and the further feature of a filter arranged at an exit side of at least one of the slits narrowing at least one of the light beams projected toward at least one of the distance measurement targets, and the at least one filter being arranged at the incident side of said at least one of the slits narrowing at least a portion of the light reflected from at least one of the distance measurement targets.

The Office Action relies on Reichard for teaching the filters recited in claim 4. The Office Action states that Reichard teaches that it is known in the art to provide at least one filter (31 of Fig. 1A) being arranged at an exit side of at least one slit (34 of figure 1A) for narrowing

the at least one of the light beams projected toward at least one of the distance measurement targets. As a motivation, the Office Action provides that the combination would have been obvious "for the purpose of filtering or reducing noise [in a] light system." (words added for clarity) Applicant disagrees.

First of all, Reichard appears to have no relation to a triangulation-type displacement sensor. Second, the filters disclosed in Reichard are "heat-reflecting optical filters" 31a and 31b, which preferentially block most of the longer-wavelength infrared radiation from the hot melt, crucible, and susceptor, in order to shield the optics chamber 17 from excessive heat and also discriminate preferentially in favor of the shorter wavelength tungsten-filament bulb illumination spectrum (col. 7, lines 4-11).

Thus, the optical filters 31a and 31b of Reichard, being for blocking infrared radiation, are not for the purpose of filtering or reducing noise. Furthermore, neither Miyoshi nor the prior art disclosed in the present application disclose reflected infrared radiation. On the other hand, the filters of the present invention are for preventing dust from entering the sensor interior from the slits (paragraph 0046).

Accordingly, Applicant submits that insufficient evidence of a motivation to combine Reichard is present and the rejection fails to establish *prima facie* obviousness for claim 4. Applicant requests that the rejection be reconsidered and withdrawn.

Claim Rejection – 35 U.S.C. § 103; Rudd, Breyer, Ikari

Claim 3

Claim 3 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Rudd, Breyer, and further in view of U.S. Patent No. 4,864,147 (Ikari). Applicant traverses this rejection.

The rejection of claim 3 relies on Ikari for teaching the claimed cylindrical lens. However, the same differences over Rudd and Breyer as in claim 2 apply as well to claim 3. Applicant requests reconsideration and withdrawal of the rejection.

Claim Rejection – 35 U.S.C. § 103; Rudd, Breyer, Reichard

Claims 5 and 6

Claims 5 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Rudd, Breyer, Ikari and Reichard. Applicant traverses this rejection.

The same arguments as in the above for claim 2 apply as well to claims 5 and 6. At least for the reasons above for claim 2, Applicant submits that the rejection fails to establish *prima facie* obviousness for claims 5 and 6.

Claim 5 is directed to the arrangement of claim 2 and the further feature of a filter arranged at an exit side of at least one of the slits narrowing at least one of the light beams projected toward at least one of the distance measurement targets. Claim 6 is directed to the same further feature in the arrangement of claim 3.

The Office Action relies on Reichard for teaching the filters recited in claims 5 and 6. The Office Action states that Reichard teaches that it is known in the art to provide at least one

filter (31 of Fig. 1A) being arranged at an exit side of at least one slit (34 of figure 1A) for narrowing the at least of the light beams projected toward at least one of the distance measurement targets. As a motivation, the Office Action provides that the combination would have been obvious "for the purpose of filtering or reducing noise [in a] light system." (words added for clarity) Applicant disagrees.

First of all, Reichard appears to have no relation to a triangulation-type displacement sensor. Second, the filters disclosed in Reichard are "heat-reflecting optical filters" 31a and 31b, which preferentially block most of the longer-wavelength infrared radiation from the hot melt, crucible, and susceptor, in order to shield the optics chamber 17 from excessive heat and also discriminate preferentially in favor of the shorter wavelength tungsten-filament bulb illumination spectrum (col. 7, lines 4-11).

Thus, the optical filters 31a and 31b of Reichard, being for blocking infrared radiation, are not primarily for the purpose of filtering or reducing noise. Furthermore, neither Miyoshi nor the prior art disclosed in the present application disclose reflected infrared radiation. On the other hand, the filters of the present invention are for preventing dust from entering the sensor interior from the slits (paragraph 0046).

Accordingly, Applicant submits that insufficient evidence of a motivation to combine Reichard is present and the rejection fails to establish *prima facie* obviousness for claims 5 and 6. Applicant requests that the rejection be reconsidered and withdrawn.

Conclusion

In view of the above, Applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert W. Downs (Reg. No. 48,222) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

By _____

RWD

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Attachments: Replacement Sheets – Figures 5 and 6